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## PROPER AND IMPROPER

# Methods of Disinfection.

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Medical School.*



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*Reprinted from the Boston Medical and Surgical Journal  
of May 24, 1888.*

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BOSTON :  
CUPPLES AND HURD, PUBLISHERS,  
94 BOYLSTON STREET,  
1888.

PRESS OF  
S. J. PARKHILL & CO., 222 FRANKLIN ST.,  
BOSTON, MASS.

## PROPER AND IMPROPER METHODS OF DISINFECTION.<sup>1</sup>

BY CHARLES HARRINGTON, M.D.,  
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FOR the proper practice of disinfection it is first of all necessary to discriminate between true disinfectants and antiseptics, the former of which destroy the vitality of micro-organisms, while the latter merely prevent or retard their development. This distinction is unfortunately not always borne in mind, and many processes of supposed disinfection are for this reason utterly valueless.

It is also of the very greatest importance that of the many agents recommended as true disinfectants none should be employed except those which have been thoroughly tried and proven by the most reliable and scientific methods, and any agent which fails to pass the requirements based on modern scientific research, should, without regard to its popularity,

<sup>1</sup> Read before the Boston Society for Medical Improvement, April 23, 1888.



ease of application, cheapness, or long record of supposed efficacy, be abandoned.

Previous to the investigations of Koch and others of the Imperial Board of Health of Germany, the processes used in disinfection were very numerous, and, owing to a lack of definite knowledge of the subject, were applied in a hap-hazard manner. The list of supposed disinfectants was very long, and included many compounds which owed their supposed value to penetrating odors. The most valuable agent for the disinfection of rooms and furniture, ships and cargoes, was for many years considered to be the fumes of burning sulphur, the efficacy of which was considered demonstrated as early as 1771, though they had been employed many centuries. Fumigation by means of chlorine, bromine, etc., was regarded as valuable, but of rather minor importance compared with sulphur. In the employment of agents which have since been proved to be valuable, no rules were followed as to proper amount or strength.

In 1881 Koch<sup>2</sup> demonstrated the unreliability of sulphur fumigations by a long series of careful experiments, begun in 1879, and conducted under the most

<sup>2</sup> Wolffhügel. Ueber den Werth der Schwefelsäure als Desinfektionsmittel. Mittheilungen aus dem kaiserlichen Gesundheitsamte. Bd. I.

scientific conditions by himself, Hueppe, Proskauer, Westphal, von Knorre, Platt and Seyd. They proved that the gas is not given off in practice anything like what it should be according to theory, that it is not diffused homogeneously, that it does not penetrate large packages beyond the surface, or the ordinary folds of clothing, and that it does not destroy the vitality of all micro-organisms even under the most favorable conditions when moisture is supplied, in which latter case, too, the articles acted on suffer more or less damage. Their conclusions, published in 1881, were that sulphur fumigations are thoroughly unreliable where there are spores, in whatever manner the process is carried out, that they are not effective against micro-organisms not on the outer surface of infected articles, and that their further employment should be wholly abandoned in favor of such agents and processes only as will destroy all infectious matter without exception.

These conclusions have been endorsed repeatedly by other experimenters, and by scientific societies and sanitary conventions. In spite of all this, however, the sulphur fumigation process still has some friends, and it is even prescribed by at least one municipal board of health. An occasional writer contributes

an article in favor of this process, but it is usually to be noticed that he writes not from experiments performed, but from older writings of others, and that he rarely alludes to the fact that the value of the process has been even disputed. Koch<sup>3</sup> showed also that zinc chloride, which has been and is now by some regarded as very active and efficient, is absolutely worthless as a disinfectant. Many other agents were shown to be worthless, and others proved to have a much diminished value. In short, the list of effective chemical disinfectants has been narrowed down to a very small number, some of which, for one reason or another, are ruled out for practical work.

At present about the only chemical disinfectants recommended by scientific men for practical purposes are carbolic acid, chloride of lime and corrosive sublimate, and the employment of these agents requires good judgment and a consideration of individual conditions. The value of these compounds has been repeatedly demonstrated, but their use is naturally somewhat restricted, in that many articles, such, for instance, as stuffed furniture, mattresses, outside clothing, etc., cannot always be treated chemically. For-

<sup>3</sup> Koch. Ueber Desinfection. Mittheilungen aus dem kaiserlichen Gesundheitsamte. Bd. I.

tunately, however, there is a physical means, which, in its place, is of equal or greater value than the chemical agents. I refer, of course, to heat.

The researches of Koch, Wolffhügel, Gaffky, Loeffler, Merke, Hueppe and Lussar, published in 1881,<sup>4</sup> and repeated and endorsed by many others, show that steam is more effective in every way than hot air at 140° C., with much longer exposure. It penetrates bulky articles much more quickly, kills all known micro-organisms and spores within fifteen minutes, and does no damage except to a limited number of articles, such as leather, furs, and veneered furniture.

Heat and the few chemicals mentioned have the approval of the leading scientists of the world, who have abandoned the clumsy, unscientific and ineffective processes long in vogue.

The cholera conference at Rome in 1885<sup>5</sup> agreed on the following among other rules regarding disinfection. The best disinfectants are steam at 100° C., carbolic acid, chloride of lime, and aeration. (Carbolic acid in solutions of two and five per cent., chlor-

<sup>4</sup>(1) Versuche ueber die Verwerthbarkeit heisser Wasserdämpfe zu Desinfectionszwecken. (2) Untersuchungen ueber die Desinfektion mit heisser Luft. Mittheilungen aus dem kaiserlichen Gesundheitsamte. Bd. I.

<sup>5</sup> Deutsche medicinische Wochenschrift, July 23, 1885.

ide of lime, one and four per cent.) For disinfection of persons, washing and baths of the weaker solutions. For disinfection of the body, bed linen, etc., the following: 1. Destruction by fire; 2. steam; 3. boiling for thirty minutes; 4. soaking in the weak solutions for twenty-four hours; 5. airing for three or four weeks, but only when other means are not available. Leather articles, boots, trunks, etc., to be destroyed or washed repeatedly with the chemical disinfectants. Vomitus and dejections to be immediately treated with the stronger solutions. Soiled linen, etc., which cannot be immediately exposed to steam, to be soaked at least twenty-four hours in the stronger solutions. These and other rules were adopted for yellow fever and other epidemic diseases. No mention was made of fumigations.

Besides thorough disinfection of the patient, the excreta, the linen, etc., etc., during and after cases of infectious diseases, there remains as a very important part of the process the disinfection of the sick room itself. Fumigations being unreliable and valueless, and steaming being naturally impossible, we must have recourse to some other means. Some experimenters recommend washing and sprinkling of the walls, floors, and furniture, with corrosive sublimate, or, as recom-

mended by Krupin and Wassilieff,<sup>6</sup> of St. Petersburg, corrosive sublimate and carbolic acid together. Others have suggested corrosive sublimate fumigations, which for obvious reasons are objectionable and dangerous. Others recommend potash soap and carbolic acid for washing floors, and carbolic spray for the walls and furniture. Esmarch,<sup>7</sup> however, shows that for walls the best method for the removal of infectious material is rubbing them thoroughly with pieces of bread, which process he shows to be efficient, not difficult of application, and unattended by danger. The micro-organisms adhere with great tenacity to the bread, which, with any crumbs which break off and fall to the floor, must be carefully removed and destroyed by fire.

For proper disinfection by steam it is essential that the proper apparatus be somewhere at hand, for without special apparatus the process cannot be carried out. By whom should the apparatus be supplied, and by whom should the process be conducted? Disinfection is more a matter of public than of private interest, and the thoroughness of the operation can best be

<sup>6</sup> Ueber Desinfection von Wohnräumen. Zeitschrift für Hygiene. Bd. III., p. 219.

<sup>7</sup> Der Keimgehalt der Wände und ihre Disinfection. Zeitschrift für Hygiene. Bd. II., p. 491.

guaranteed when the process is carried out by competent public authority. It is far better to spend the public money for the prevention of disease than for its treatment. The direct cost may, in many cases, it is true, be less in the treatment than in the prevention, but in the long run as is shown by statisticians, sickness and death of individuals are a distinct loss to the State. Disinfection should be free to the public, for expense to the individual will always be an obstacle to thorough work. It is true that when a privilege is free it will be abused, and, as has been remarked by Professor Hofmann,<sup>8</sup> of Leipzig, dirty clothes not infected may be brought for the sake of the improvement in appearance, and feather beds for the renovation which the steam gives them, but the abuse of the privilege might be very easily kept under control by simple regulations.

Of the apparatus for steam disinfection I will presently speak in detail.

With the few necessary chemical and physical means of disinfection, and the proper apparatus, and with a proper observance of simple rules, there is no reason why disinfection should not be carried out on scien-

<sup>8</sup> Moderne Desinfectionstechnik mit besonderer Beziehung auf öffentlichen Disinfectionanstalten. Bericht der xlii Versammlung der deutschen Vereins für öffentliche Gesundheitspflege zu Breslau.

tific principles in every city and town. Public health authorities have no right to retain old abandoned processes whose utter unreliability has been proven by the highest scientific authority. If the retention of obsolete processes is owing to ignorance, such ignorance is more than unpardonable; if not due to ignorance, then it must be owing to a disbelief in what every leading sanitarian in Europe and elsewhere has endorsed.

Considering the great strides that have been taken in this subject within the past ten years, it is wrong — and I might with justice use a stronger term — to teach the public a process of disinfection that is worse than useless, in that it leads to a false sense of security, and to compel its employment under heavy penalties; it should be taught true disinfection, or none. It is difficult at best to educate the public in sanitary matters, but far more so to root out the results of improper teaching.

As a proper method of disinfection, I will instance that adopted by the authorities of Berlin. Disinfection is required absolutely in certain diseases, and conditionally in certain others. The public are taught that thorough cleanliness, frequent airings, speedy removal and destruction of infectious material are most

important parts of a whole. It is recommended that the patient be washed daily, and that the body and bed linen be changed as often as once a day if possible. Soiled linen must be changed immediately. The room should be cleansed daily by wiping down with moist cloths, which afterwards must be treated with boiling water for half an hour. The room should be aired frequently and thoroughly by opening the windows. Steam, boiling water, burning, and solutions of carbolic acid, two and five per cent., are adopted as proper disinfectants. All bed and body linen, and all cloths used for wiping down, must be soaked twenty-four hours in two per cent. carbolic, then boiled a half-hour in water, and finally washed with soft-soap solution (twenty grams to ten litres). Infectious dejections, sputa, etc., must be received in vessels a quarter full of five per cent. carbolic acid. If the patient should use the water-closet the seat and receiver must be scoured with five per cent. carbolic acid and thoroughly rinsed. Food and drink are not allowed in the sick-room, except as required for the patient alone. Old dressings, etc., are burned, instruments washed in five per cent. carbolic acid, and bad smells got rid of by removal of their causes.

On the cessation of the sickness all unwashable

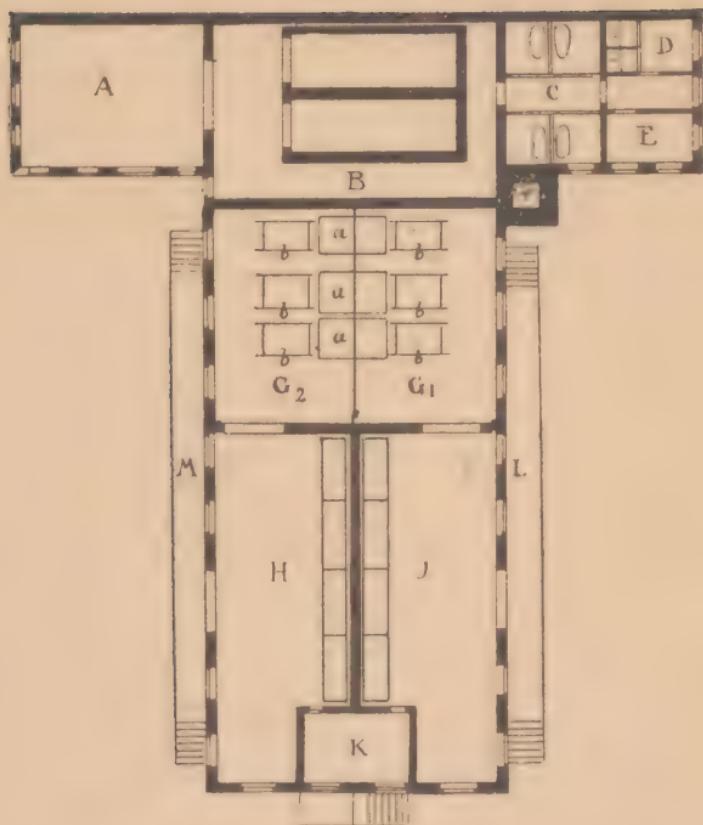
clothing, beds, pillows, mattresses, coverlets, silks, carpets, etc., etc., are tied up in sheets wet with two per cent. carbolic, and taken by the authorities to the public disinfecting station. Valueless material is burned forthwith. Certain articles of ornament and furniture may be wiped down with cloths; and tapestries, hangings, etc., with bread, but the floor must first be wetted with five per cent. carbolic acid. Any soiled places on the walls (from excreta) are moistened with five per cent. carbolic acid, and scraped off. Floors, doors, windows, etc., are washed thoroughly with carbolic solution, five per cent. The bread and rags used must be burned. When the room with its contents have been well cleansed it must be aired for twenty-four hours. Other rules have reference to the disposal of the dead, and to the attire and personal habits of the attendants, etc., etc.

The articles to be carried to the public disinfection station are called for and returned by the authorities. They are taken away in a closed wagon by experienced men, who during the handling and packing are attired in long linen coats reaching to the feet. On leaving the infected house these coats are sprinkled with carbolic five per cent., folded, and packed with the other infected articles in the wagon. The articles

removed are incased in linen wrappers and sacks well moistened with carbolic. Carpets are rolled and not folded, thus avoiding permanent creases which would be caused by steaming. When everything has been packed in the wagon the driver takes the shortest road to the station, and enters the yard on the right (see cut). The infected articles are then unloaded at the platform L, after which the wagon itself is washed with five per cent. carbolic, or corrosive sub-limate 1:6000, and stowed in a shed.

Before proceeding to a description of the manner in which the work is done, a brief explanation of the plan of the building will not be out of place.<sup>9</sup> A is a store-room for coal and a repair shop. B is the boiler room, containing two boilers, in which the steam is kept under a moderate pressure. C and D are bath-rooms and water-closets for the attendants. E is a store-room for chemicals. The steam passes from the boilers to the apparatuses a, a, a, from which it escapes to the chimney F. The articles to be subjected to steam are loaded into the apparatus in the room G 1; previous to this operation they are stored in the room

<sup>9</sup> I am indebted for the plan, description, etc., to the article by H. Merke. *Die erste öffentliche Desinfektions Anstalt der Stadt Berlin. Vierteljahrsschrift für gerichtliche Medicin und öffentliches Sanitätswesen.* Berlin, 1874, p. 1.



J, which is well provided with racks, shelves, hooks, etc. After the operation of steaming is finished the articles are unloaded from the apparatus in the room G<sub>2</sub>, and are stored in H, which is similar to J. There is no possibility of re-infection of the disinfected articles in H by infectious material in J or G<sub>1</sub>, as there is no communication between the two sides of the building. K is an office, which is

shut off from H and J excepting by two windows, of which the one looking into the store-room for infected articles (J) is hermetically sealed. Communication between J and K is by means of a telephone. Disinfected articles are loaded into another special wagon, at the platform M, and are carried away through the yard on the left.

The process of steaming as carried out is briefly as follows. The articles are loaded into trucks or cages which run into the apparatus a, a, a; the doors of the latter are then tightly closed. The steam is turned on for thirty-five minutes, at the end of which time the apparatus is ventilated for ten more. The attendants in G 2 are then notified by means of a bell that the apparatus is ready for unloading. This is done, the doors of the apparatus opening into G 1 remaining closed until the bell again rings, which is a signal that the trucks have been replaced, that the doors into G 2 are shut, and that the next loading may be begun. When steaming is in any case contraindicated the disinfection is carried on in the usual way with chemical washes.

Many other cities of Europe have these stations for steam disinfection, and there is no reason why we should not have them in this country. It would, of

course, be unreasonable to require small towns to provide such elaborate systems, and it would be also unnecessary. Portable steaming apparatuses have been devised for use in small towns and thinly-settled localities, so that proper disinfection is everywhere possible at a very moderate expenditure for transportation, labor and fuel.



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